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CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—No. CLIX

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II. Eastern North American Representatives of Alnus incana

(Plates 976–989)

In 1906, while he was a student with me, Dr. Harley H. Bartlett joined me in collecting at different stages of development through the season material of the Swamp Alders of northeastern Massachusetts, for it was quite apparent that the variations within this group were not satisfactorily disposed of merely by calling them all simply *Alnus incana* and *A. serrulata* or *rugosa*. With the cooperation of the late Professor J. Franklin Collins in Rhode Island, we assembled many collections but their final identification was interrupted by Bartlett's finishing his studies at Cambridge and the mass of material was stored, with the hope that one of those eclectic students, who specialize on our trees and shrubs, to the exclusion of herbs, would be interested to clarify the situation. More than quarter of a century later, when he was studying with me, Dr. Ernst C. Abbe, working primarily on morphological problems in the *Corylaceae* (*Betulaceae*), made a fresh start on the problem and, although he was obliged to cut short this special work, he had, before he finished, assembled striking evidence that the shrub or small tree, which in North America passes as the Eurasian *A. incana*, really differs from that species in very many important characters. Following up Abbe's unfinished studies, I undertook to conclude the quest and a decade or more ago wrote the introduction to the present paper.

Interrupted by more immediately pressing matters, I likewise failed to bring the study to completion. Now, after these repeated interruptions, I am again endeavoring to set the group in such order as I can establish in it. Fortunately but somewhat unhappily, I am faced by vastly more numerous, though more satisfactorily made, collections to deal with than Bartlett and I had before us 39 years ago, for wherever I have been, in Newfoundland, eastern Canada, New England, New York, Michigan or Virginia, my companions and I have had our eyes open for variations of the Alders. The present paper cannot, therefore, be called a hasty and off-hand study.

The name *Alnus incana* for the common Swamp Alder of the Labrador Peninsula, Newfoundland, eastern Canada and the more northeastern United States (PLATES 977–982) has been so thoroughly established, especially since Edward Tuckerman in 1843 so identified the northern shrub or small tree with leaves glaucous beneath, that to those who are more influenced by long-established usages than by precision its abandonment might seem mere iconoclasm. At the beginning, however, the name belonged strictly to a Eurasian tree and, of course, it must be retained for that variable but morphologically definite species. True *Alnus incana* (L.) Moench (PLATE 976) was so named because of the hoary (incanous) pubescence which so generally characterizes it; ordinarily its leaves are permanently quite gray with soft and velvety pilosity, as are the young branchlets and the axes of the inflorescences. The terminal lobes (FIGS. 5 and 6) of the bracts of the pistillate and fruiting aments (FIGS. 4 and 5) are depressed and slightly recurving or sometimes almost suppressed. This species is found in North America only in cultivation or where introduced from Europe, as formerly on the sand-hills near Provincetown, at the tip of Cape Cod, where it was originally planted and was abundant as late as 1919 (*Fernald & Long*, nos. 18,354, 18,355 and 18,360) but where, by 1944, none of it seems to have persisted.[1]

[1] The introduction of European plants for the reclamation of the sand-dunes back of Race Point Life Saving Station near Provincetown is typical of much of the practice in holding or reclaiming loose soils. The natural dunes of Cape Cod are very effectively and automatically reclaimed by the indigenous eastern North American *Ammophila breviligulata* Fernald and *Pinus rigida* (Pitch Pine), while the Alders of the dunes and hollows are endemic Americans. Nevertheless, the reclamation of the dunes of the old province-lands was largely attempted through the planting of imported

The eastern North American shrub or (rarely) small bushy so-called tree (PLATES 977–982) which erroneously passes as *Alnus incana* is not truly incanous. Its new branchlets and the axes of its inflorescences, are, with rare exceptions, glabrous or only very sparsely pilose and very gummy, having, when dry, a crackled or subverrucose surface. The oval or ovate to round-elliptical and usually coarsely undulate or doubly toothed leaves are less pubescent or glabrous beneath or, if strongly pilose, with usually rufescent pubescence. The pale cross-veins (between the strong parallel ribs) are, in mature foliage, coarse and prominent beneath (PLATES 977, FIG. 2, 978, FIG. 2, and 979, FIG. 4), freely confluent and forming a conspicuously scalariform and rugose pattern, the veins in European *A. incana* (PLATE 976, FIG. 2) being very slender and comparatively delicate. In the American species the pistillate aments are usually more numerous than in the European species; and the outer lobes of the summit of each bract of the pistillate cone are suberect or arching and prolonged (PLATES 977, FIG. 3, and 978, FIGS. 3 and 5). That the so-called *A. incana* of North America is really very different from true Eurasian *A. incana* is quite obvious; but for clarity of discussion this American shrub, which for more than a century has erroneously passed with us as Old World *A. incana*, may be temporarily designated SPECIES NO. 1.

All the characters above noted are such as can be seen in a good herbarium. Others of equal significance are not often there displayed. Eurasian *Alnus incana* is a large shrub or, more often, a considerable tree, up to 35 or even to 85 feet high and with single erect trunks up to 3 feet in diameter, the cortex lustrous and whitish-gray. "In . . . Europe . . . in the south . . . sometimes attaining a height of seventy feet; it is the common Alder of Siberia and southeastern Asia [this

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European White Alder, Scotch Pine and Scotch Broom; but the Broom is there now relatively unimportant, the Scotch Pine is secondary to the native Pitch Pine, and the European Alder has not survived. That is as it should be: the climate of the dunes of western Eurasia, with prevailingly western winds off the Atlantic, is so unlike the dry and hot summer conditions at the eastern border of North America, that western European shrubs are too much handicapped. Some years ago I received a call from an American soil-conservator who stated that he was going on a federal government mission to India, to find some Asiatic species which would control erosion in our "dust-bowl". A few days later I had a brief visit from a prominent botanist of India, who had been sent to America by his government to see if in our "dust-bowl" he could secure some plant to control wind-erosion in India. Tra-la-la!

sometimes separated], . . . a stately tree fifty or sixty feet in height, with a trunk often two or three feet in diameter"—Sargent, Silva, ix. 69, in footnote (1896). "Strauch oder bis 10 (25) m hoher Baum. . . . Rinde glatt, glänzend weissgrau"—Hegi, Ill. Fl. Mitt.-Eu. iii. 89, with illustration of the arborescent habit as fig. 483. "Arbre à écorce lisse, d'un gris blanc"—Rouy, Fl. France, xii. 261 (1910); "meist 6 bis etwa 23 m hoch, in der Tracht der *A. glutinosa* ähnlich, aber meist niedriger, mit ziemlich dichter Krone. Stamm glatt mit hellgrauer Rinde"—Ascherson & Graebner, Synop. Mitteleur. Fl. iv. 423 (1911). Certainly the North American shrub or bushy "tree", which for a century or more has passed as *A. incana* (our SPECIES NO. 1), does not have sufficiently erect or solitary trunks to rank as a real tree; otherwise it would have been included among the trees in such compendious works as Sargent's *Silva* and his *Manual of the Trees of North America* and in Britton's *North American Trees*, in none of which is it included. If a tree, it should also be in Sudworth's *Check List of the Forest Trees of the United States*. Rightly enough, however, *A. incana* is mentioned by Sudworth only in a footnote as "a shrub", "as it occurs in northeastern North America and United States" (Sudworth, p. 80). In a footnote Sargent, Silva, l. c., refers to it (as *A. incana*) in the following terms: "In North America, where it is the common Alder of swamps and river-banks in the northeastern parts of the continent, forming dense shrubby thickets rarely more than ten or twelve feet high"; while F. A. Michaux, describing it as his *A. glauca* and comparing it with *A. serrulata*, said "c'est-à-dire qu'on en trouve souvent des individus qui ont de 18 à 20 pieds . . . de hauteur, sur environ 3 pouces (12 centim.) de diamètre". And surely the cortex of our northern shrub is never *whitish gray*, the color so consistently stated by Eurasian botanists for their *A. incana*. The thin cortex of ours is a warm purple-black, purple-brown or gray-brown, with conspicuous elongate white lenticels (PLATE 980, FIG. 2). "L'écorce qui couvre le tronc, ainsi que les branches secondaires, est d'une teinte brune très-foncée" (Michx. f. in describing his *A. glauca*); "bark gray brown with lighter horizontal markings" (Mathews, Field Book Am. Trees and Shrubs, 126). "A shrub 8–20 feet high; the stem sometimes 3–4 inches in diameter, with a smooth brown bark"—

Torrey, Fl. N. Y. ii. 202 (1843). In fact, so dark is the bark that, when the younger Michaux published his *Alnus glauca*, with "*foliis subrotundò-ellipticis, duplicatò-serratis, subtùs glaucis*", he gave our shrub of "les États du New-Hampshire, Massachusetts et de Vermont" which has the foliage so "vert pâle et comme bleuâtre, ce qui les fait reconnoître au premier abord", the English name "*BLACK ALDER*"; whereas in Europe *A. incana* is frequently called "WHITE" or "GRAY ALDER". Furthermore, in Europe witches' brooms (*Hexenbesen*) are frequent on *A. incana*, sometimes as many as 100 on a single tree; our dark-barked northeastern shrub, Professor Faull informs me, has never been known to produce them; and Professor Arthur Stanley Pease tells me that his students in Latin, familiar with the shrubbiness of alders in eastern North America, always have a great laugh as they read passages (at least 11 of them) by the Latin poets, telling of ships built of alder! Surely no argument beyond the mere facts and the plates is needed to show that we have been far astray in calling our northern Swamp Alder the same as the Eurasian *A. incana!*

The only other indigenous Swamp Alder of temperate North America, excluding the quite definite autumn-flowering *Alnus maritima* (Marsh.) Muhl., is the generally more southern shrub (PLATE 983–989) with the white lenticels of the bark much smaller than in SPECIES NO. 1 or often very obscure (PLATE 985, FIG. 5); the leaves of a generalized obovate type, mostly subcuneately narrowed (but sometimes more rounded) to base, usually with regularly or subuniformly fine-serrulate margins, with cross-veins beneath (PLATES 984, FIG. 4, 985, FIG. 4, 987, FIG. 4 and 988, FIG. 3) more delicate and less conspicuous, the lower leaf-surfaces fulvous-green to reddish, glabrous, glabrate or reddish-pubescent; the axis of the pistillate inflorescence (PLATES 983, FIGS. 3 and 4, 985, FIG. 3, 986, FIG. 3, 988, FIG. 4, and 989, FIG. 4) commonly with right angles or strongly geniculate bends. The outer terminal lobes of the cone-bract (PLATE 986, FIG. 4) are low and broadly rounded. This shrub, the northern limits of which interlock with the southern outposts of SPECIES NO. 1, long passed correctly as *A. serrulata* (Ait.) Willd.; but, especially since Karl Koch in 1872, Coulter in 1894 and Sargent's Silva (1896), it has recently been incorrectly passing as *A. rugosa* (Du Roi) Sprengel. Since the

latter name must be considered in connection with SPECIES NO. 1, it will make for clarity, until the application of the various names is investigated, to designate the more southern shrub as SPECIES NO. 2.

Almost from the start, at least beginning with Willdenow in 1796, the names *rugosa* and *serrulata*, whether under *Betula* or *Alnus*, were hopelessly confused. Regel at last got them clearly separated but, depending chiefly on variable leaf-outline and -pubescence, without noting the striking differences of bark and inflorescences, he maintained them both as variations of one species. With the two eastern American species defined as SPECIES NOS. 1 and 2 and clearly shown in the plates, we may proceed to examine the specific names published for them, somewhat in chronological order, that we may settle their correct application. In so doing I am omitting the several *nomina nuda* of Steudel and others, undefined names which by various authors have been placed in the vague synonymy of one or another of the properly defined ones.

The first of these two American species defined was *Betula Alnus* (*rugosa*) Du Roi, Obs. Bot. p. xxxii (1771). The original diagnosis and discussion of the shrub growing in the botanic garden of Harbke near Brunswick was as follows:

> 5. BETULA ALNUS (*rugosa*) foliis mucronatis acute serratis, subtus venoso-rugosis.
>
> *Germ.* Nordamerikanische Eller.
>
> Habitat in America septentrionali.
>
> Species horti Harbeccensis *foliis* ovatis mucronatis, acutius serratis et angustioribus, quam in B. Alno incana, viridibus glabris, subtus venis albidis rugosis. *Rami* tenues, cortice nigricante. E semine misso culta arbor in horto nondum adhuc floruit.

This was followed by the fuller account in Du Roi's detailed Die Harbkesche wilde Baumzucht, i. 112 (1771):

> 3. BETULA Alnus (rugosa) foliis mucronatis acute serratis, subtus venoso-rugosis.
>
> The American Alder.
>
> Aune d'Amerique septentrionale.
>
> Die Nordamerikanische Eller.

Sie unterscheidet sich deutlich von den beiden vorigen, und ist hier aus Saamen gezogen, welcher aus Nordamerika geschickt worden ist.

> Die **Blätter** erscheinen schmaler als bei den vorhergehenden, und in den mehresten an vier Zoll Länge und zwei Zoll Breite. Sie sind oval zugespizt, am Rande scharf und fein gezahnt, auf der oberen Fläche hell grün und glatt, und auf der unteren ebenfals hellgrün. Auf der lezteren lauft der Länge nach eine weissgrüne erhabene Ader hin, welche in schrägen Linien nach dem Rande aus etwas feinere Nebenäste Paarweise gegen einander über ausschicket, und aus diesen lezteren kleinen Adern gehet ein Gewebe noch kleinerer Adern heraus, die das Blatt etwas runzlicht bilden.
>
> Die äussere Rinde ist dunkelgrau an alten Zweigen, an iungen aber grün.

Ehrhart, improving on the trinomial nomenclature of Du Roi, redescribed the shrub growing in the Harbke Garden as *Betula rugosa* (Du Roi) Ehrh. Beitr. iii. 21 (1788).

> 6. *Die Haselelle r.*
> *Betula rugosa.*
> Betula gemmis elevatis, obtusis; foliis ovatis, acutis, repando-angulatis, serratis, nudis, superne glabris, subtus venoso-rugosis; racemis subtristrobilis, aphyllis.
> Ihr Vaterland ist Nordamerika.
> Die Plantage zu Herrnhausen, die Gärten zu Harbke, Destedt und mehrere haben sie.
> Betula Alnus rugosa. Duroi baumz, v. i, p. 112.

Sprengel, too, in transferring the species to *Alnus*, in Syst. iii. 848 (1826), was equally clear:

> *rugosa** 8. A[lnus] foliis basi rotundata ovato-oblongis acutis duplicato-denticulatis subtus rugulosis, axillis venarum villosis. *Amer. bor.*

but Sprengel made the serious mistake of suggesting identity with the Peruvian *A. acuminata* HBK.

From the original accounts of Du Roi, Ehrhart and Sprengel, then, it is clear that *Alnus rugosa* rests upon material cultivated in Germany and having dark or blackish bark, leaves ovate or oval, acutish, rounded at base, doubly toothed, green and glabrous or glabrescent beneath, a leaf which so resembles that of *Corylus* as to suggest to Ehrhart the name "*Haseleller*" (Hazel-Alder). These descriptions are so vivid for the common extreme of the shrub of northeastern America which has erroneously passed as the European *A. incana*, var. *hypochlora* Call.[1], that it is doubly reassuring to see a photograph (our PLATE 979, FIG. 1) of a speci-

[1] As by Fernald in RHODORA, xxiii. 257 (Feb. 27, 1922).

men distributed by Ehrhart as his *Betula rugosa* and coming from the Harbke Garden. The photograph, for the use of which I am indebted to Professor Alfred Rehder and the Arnold Arboretum, was taken by Professor Rehder at the Botanical Museum at Berlin-Dahlem; and, since the destruction of that invaluable herbarium, it is a most fortunate photograph to have. The foliage shown is young first-year leaves and is closely matched by the leaves on young and vigorous sprouts of our greener-leaved so-called "*A. incana*, var. *hypochlora*". Surely no one, familiar with the obovate and usually cuneate-based leaf of *A. serrulata*, would think of matching the latter with the authentic foliage from the Harbke Garden. Neither would they call our *A. serrulata* "Hazel-Alder". That name is wholly appropriate for our shrub (SPECIES NO. 1) which has been passing as *A. incana*. A characteristic leaf was shown by Regel in his *Monographia Betulacearum* in Nouv. Mém. Soc. Nat. Mosc. xiii. 165, t. xi. fig. 8—repr. as Mon. Bet. 107 (1861)—of the shrub "in den Gärten Europas" and which Regel, with remarkable conservatism, called *A. glutinosa*, lusus *rugosa!* Regel in 1861 stated that the shrub was widely grown in the botanical gardens of Europe and he identified with it the *A. hybrida* of Alexander Braun in Reichenb. Ic. Fl. Germ. xii. 3, t. 630, fig. 1292 (1850), which had been found wild in various parts of Germany and in Bohemia. Such a shrub, from a wild habitat in Wittenberg, was distributed in *Baenitz. Herb. Dendrol.* no. 1214, as *A. rugosa*. This material, unlike the Ehrhart specimen, shows mature fruiting branches with the characteristic cones and the typical foliage of fruiting branches of our greener-leaved "*A. incana*". It is shown in our PLATE 977. Native American specimens, almost like it in every respect, are shown in PLATE 978.

Confusing as it may temporarily prove, there seems to be no escape from taking up for the North American shrub which passes as *Alnus incana*, our SPECIES NO. 1, its earliest name, A. RUGOSA (DuRoi) Spreng.

Chronologically, the names of Humphrey Marshall, Arb. Am. 20 (1785), have to be noted. The first, "BETULA-ALNUS glauca. *Silver-leaved Alder*" of "low marshy ground", had no diagnosis whatever but from its names may be inferred as being the common northern variety of *A. rugosa*, which reaches northeastern

Pennsylvania, a species which had already been described by DuRoi (1771) and which in 1813 F. A. Michaux properly described and illustrated, with no reference to Marshall, as *A. glauca*. Marshall's second species, "BETULA-ALNUS maritima, *Sea-side-Alder*", was sufficiently defined as to give an unquestioned basis for *A. maritima* (Marsh.) Nutt., a clear-cut autumn-flowering species which we are not here discussing. His third had no good description, merely very brief and inconclusive comments. though geographically it was obviously intended for *A. serrulata* (Ait.) Willd., our SPECIES NO. 2. This was

> BETULA-ALNUS rubra. *Common Alder.*
> This grows very common in most parts of Pennsylvania.
> The leaves are broader than the other kinds and rough or wrinkled.
> This flowers in the spring, and perfects its seeds in the fall.

From its abundance in Pennsylvania Marshall's species, as said, should be some form of *Alnus serrulata*. The leaves "broader than the other kinds and rough or wrinkled" is inconclusive but there are plenty of broad-leaved variations of *A. serrulata*. Tuckerman interpreted it as unmistakable *A. serrulata* and described *A. rubra* (Marsh.) Tuckerm. in Am. Journ. Sci. xlv. 32 (1843), with leaves obovate and with *Betula serrulata* Ait. and *A. serrulata* (Ait.) Willd. as synonyms, Tuckerman giving the naïvely nationalistic explanation:

> The name of our own botanist should have the priority: his description, though short [he might have said inconclusive], notices the most striking features of the species, and cannot be mistaken. The A. rubra of Bongard [1833], is many years later [than *Betula-Alnus rubra*]. Add to this, that Marshall's name is far more expressive and apt than that of Aiton [1789].

Nevertheless, *Alnus rubra* Bongard (1833), the Pacific North American species, has right of way and under present-day rules no other species can validly bear the same name, even though its name-bringing typonym was earlier. *A. rubra* (Marsh.) Tuckerm. (1843) is fortunately, in view of its vague origin, a later homonym.

The next name, chronologically, was *Betula serrulata* Aiton, Hort. Kew. iii. 338 (1789). Aiton's diagnosis was brief but its characterization of the leaf definite:

serrulata. 11. B. pedunculis ramosis, foliis obovatis acutis; venis et axillis venarum subtus villosis, stipulis ovalibus obtusis.
Notch'd-leaved Alder Tree.
Nat. of Pensylvania.
Cult. 1769, by Peter Collinson, Esq.

That *Betula serrulata* was our SPECIES NO. 2 (especially as shown in PLATE 983) is clear from the *obovate*, *acute* leaves; but, with wholly vague conceptions of our two species, European authors promptly produced confusion of names, like most botanists who study names to the exclusion of the plants! Thus, Willdenow, in his Berlinische Baumzucht, 45 (1796), took up *Betula serrulata* with Aiton's original diagnosis of 1789 and placed unquestioningly in its synonymy *B. rugosa* Ehrh. (1788), which went back to Du Roi's original publication of 1771. And later, when he made the combination *Alnus serrulata* (Ait.) Willd. Sp. Pl. iv[1]. 336 (1805), Willdenow merged with this species, correctly described "foliis obovatis", the above discussed *Betula rugosa* "foliis ovatis . . . repando angulatis". Further augmented by the failure of André Michaux (1803) definitely to distinguish our two species, the mixing of the two, started by Willdenow in 1796, became general and, consequently, has resulted in the recent erroneous and highly uncritical application of the name *A. rugosa* to the abundantly different and usually more southern *A. serrulata*. Michaux's confusion of the two may be stated as follows: in his Flora Boreali-Americana, ii. 181 (1803) he described *Betula rugosa* (American "*incana*") as *B. serrulata* "foliis lato-ovalibus" and then added the

> *Obs*. Folia saepe obovalia, interdum subglanduloso-repanda, basi semper acuta,

the observation referring to the relatively southern *A. serrulata*. Michaux gave the range from "Pensylvania ad Carolinam", the specimen in his Herbarium at Paris, which I examined in 1903, being of the southern species. Somewhat surprisingly, André Michaux, who had explored eastern Canada as far north as Rupert River and west to Lake Ontario and who knew northern New England, gave no intimation in his Flora that there is any Alder of this group north of his "Pensylvania ad Carolinam". Having collected *A. serrulata* in that area, he possibly did not further feel any special interest in the group; at any rate,

the only Alder he noted from Canada in his Flora was *Betula crispa* Ait. More probably, however, northern material was lost before the writing of the Flora Boreali-Americana. It is fairly clear that Michaux recognized the northern species as distinct from the southern, for in his Journal—*Journal of André Michaux. 1787–1796. with an Introduction and Notes*, by Charles Sprague Sargent, Proc. Am. Phil. Soc. xxvi. no. 129 (1888)—he noted, among the plants seen on his trip up the Saguenay and across to Lake Mistassini, "Alnus glauca stipulis lanceolatis" (Sargent, l. c. 75, under "Le 15" of August). To be sure, Sargent (l. c.) identified Michaux's *Alnus glauca* as *Betula pumila*, but Michaux knew the difference, for on the 19th of August on "la riv. ditte Mistassin", he specially noted *Betula pumila*.[1]

F. A. Michaux, the son, carried the confusion still further, describing *A. serrulata* "foliis duplicatò-serratis, ovalibus, acutis"[2], stating that it is found in the Northern, Central and Southern States ("on la trouve aussi bien dans les États du Nord que dans ceux de Centre, du Sud et de l'Ouest"), and illustrating the round-based doubly serrate leaf of typical *A. rugosa*, already discussed. With such inauspicious beginnings, it is little to be wondered at that the correct applications of the names *A. rugosa* and *A. serrulata* have been hopelessly confused by those who have relied more upon "the books" than upon the morphological characters of the plants.

The next specific name to consider is *Alnus glauca*. Although the undefined name "BETULA-ALNUS glauca" had been used by Marshall in 1785, that publication was not cited by F. A. Michaux when he described and illustrated his own *Alnus glauca*, Michx. f. Hist. Arb. Forest. Am. Sept. iii. 322, t. 4, fig. 2 (1813). The diagnosis and figure are unequivocal, the former being

[1] Unfortunately, most others of Sargent's identifications of Michaux's plants need correction. For instance, "Sparganium natans", collected on the same trip, was identified by Sargent (p. 75) as *S. minimum*. Michaux's collection, labeled "Hab. in Amnibus à Québec ad Lacus Mistassins", was the type of *S. angustifolium* Michx. Fl. Bor.-Am. ii. 189 (1803), the only species of the genus in the *Flora*. Similarly Michaux's Journal recorded as growing with the *Sparganium* and near the *Alnus* "Alisma subulata", which Sargent identified as "*Alisma Plantago*, L. var. *Americanum*, Gray". But Michaux knew the broad-leaved plant and in his Flora, i. 218, had it as *A. Plantago*. He there included *A. subulata* L. from Florida only, the plant now known as *Sagittaria subulata* (L.) Buchenau. The plant of Canada, which Michaux mistook in the field for *Alisma subulata* L., is the type of *Sagittaria graminea* Michx. Fl. Bor.-Am. ii. 190 (1803).

[2] Michx. f., Hist. Arb. Forest. Am. Sept. iii. 320, fig. 1 (1813).

ALNUS *glauca, foliis subrotundò-ellipticis, duplicatò-serratis, subtus glaucis,*

the species said to be unknown in the South, very rare in the Middle States but abundant in New Hampshire, Vermont and Massachusetts ("Cette espèce d'Aulne qui ne se trouve pas dans les États du Sud, qui est assez rare dans ceux du Milieu, est, au contraire, plus multipliée dans les États du New-Hampshire, Massachusetts et de Vermont"). The description, figure and abundance in northern New England clearly indicate the common shrub of the North with gray or glaucous lower leaf-surfaces (PLATES 980 and 981), which erroneously and almost universally passes as the Old World *A. incana*, the only possible excuse for such an interpretation being the glaucous lower surface of the leaves. This familiar shrub is, of course, one of the extreme and usually most northern variations of *A. rugosa.*

In 1894, the late Dr. Britton collected on Staten Island fruiting material from a "large alder in swampy woods, . . . ; these were at the time referred to *Alnus incana*, though with doubt, inasmuch as the height of the tree seemed much too great for that species, and the large, strongly pointed leaves seemed also to be different from those of any specimens of *incana* that I had seen. The woods in which this tree grew were cut away soon after my collection was made, and, though a search was made in the vicinity for other plants, I was never able to find another specimen".—Britton in Torreya, iv. 124 (1904). Since, however, the late Eugene P. Bicknell subsequently found somewhat similar shrubs on Long Island, the Staten Island specimen was made the type of *Alnus noveboracensis* Britton in Torreya, l. c. (1904) our PLATE 995. It was more fully described and illustrated in Britton, N. Am. Trees, 264, fig. 224 (1908), but in Britton & Brown, Ill. Fl. ed. 2, i. 613 (1913) it was noted after "*A. rugosa*", i. e. *A. serrulata*, with the justifiable comment: "It may be a race of this species". The latter disposition of it seems about right; it is an occasional and rather marked extreme in the broad range of *A. serrulata*, from Maine to Georgia, Tennessee and Louisiana. Unfortunately the type from Staten Island, which I have before me through the courtesy of Dr. Gleason, had been badly pressed, poorly mounted and seriously broken. It is, therefore, not a very good subject for illustration, but in PLATE 985 Dr. Schubert has cannily covered the most broken parts.

Numerous varietal names must be considered but, since they do not disturb the specific epithets which we must apply to our two native species, their discussion will be deferred until the varieties of the two species are defined.

As I understand our spring-flowering native Alders of this group they fall into the two species following.

Cortex of trunks and older branches bearing abundant linear transverse whitish lenticels up to 7 mm. or more long; axis of young or flowering inflorescence arching, without right angles, the pistillate branch or branches (in monoecious inflorescences) then drooping and appearing to be below the staminate ones; leaves ovate, oval, subelliptic or rounded, broadest below or near the middle, with rounded to subcordate bases, oftenest double-serrate or -dentate, often repand-undulate, not at all or only slightly glutinous, the mature blades with the cross-veins beneath prominent and forming ladder-like reticulation between the main lateral veins.....1. *A. rugosa.*

Cortex with fewer and shorter orange to gray lenticels or these obsolescent; axis of young inflorescence with 1 or more abruptly geniculate or right-angled bends, the pistillate branches erect or strongly divergent and thus appearing to be above the drooping staminate ones; leaves obovate or obovate-elliptic, broadest above middle, cuneate to but slightly rounded at base, simply serrulate, only exceptionally strongly undulate, the expanding ones glutinous, often aromatic, the mature blades with the lower surface delicately or finely reticulate or with only weak cross-veins.....2. *A. serrulata.*

1. A. RUGOSA (Du Roi) Spreng. Syst. iii. 848 (1826).—The following varieties and forms are recognized.

a. Leaves green or fulvous, not glaucous, beneath.
  Lower surfaces of leaves glabrous or promptly glabrate, only the principal veins or their axils sometimes permanently pilose.....Var. *typica.*
  Lower surfaces of leaves permanently soft-pilose or subvelutinous (to touch).....Forma *Emersoniana.*
a. Leaves glaucous or whitened beneath....*b.*
  b. Lower surfaces of leaves glabrous or promptly glabrate.
    Leaves ovate or oval to rounded-elliptic, with low toothing.....Var. *americana..*
    Leaves narrowly elliptic to ovate-lanceolate, lacerate or jagged-toothed.....Forma *tomophylla.*
  b. Lower surfaces of leaves densely soft-pilose or subvelutinous (to touch).....Forma *hypomalaca.*

A. RUGOSA, var. TYPICA H. Winkl. in Engler, Pflanzenr. iv[61]. 119 (1904), as to name of the type. *Betula Alnus* (*rugosa*) Du Roi, Obs. Bot. 31 (1771) and Harkb. Wilde Baumz. i. 112 (1771). *Betula rugosa* (Du Roi) Ehrh. Beitr. iii. 21 (1788). *A. serrulata* sensu Michx. f. Hist. Arb. Forest. Am. Sept. iii. 320, fig. 1 (1813), not Willd. (1805). *A. rugosa* (Du Roi) Spreng. Syst.

iii. 848 (1826); Callier in Mitteil. Deutsche Dendr. Gesellsch. 1918: 114 (1918), in small part only (a bad mixture). *A. latifolia* Desf. Cat. Pl. Hort. Par. ed. 3: 352 (1829), *nomen nudum*, cited in synonymy of the next by Spach (1841). *A. hybrida* A. Br. ex Reichenb. Ic. Fl. Germ. xii. 3, t. 630, fig. 1292 (1850). *A. serrulata*, β. *macrophylla* Spach in Ann. Sci. Nat. sér. 2, xv. 206 (1841). *A. macrophylla* Desf. ex Spach, l. c. in synonymy (1841). *A. autumnalis* Hartig. Naturgesch. Forste, Kulturpfl. 337 (1850). *A. glutinosa*, δ. *serrulata*, lusus c. *rugosa* (Du Roi) Regel in Nouv. Mém. Soc. Nat. Mosc. xiii. 165, t. xi. figs. 8–10—repr. as Mon. Bet. 107 (1861). *A. serrulata* β. *rugosa* (Du Roi) Regel in DC. Prodr. xvi². 188 (1868). *A. glutinosa*, var. *autumnalis* (Hartig) Ktze. Rev. Gen. ii. 638 (1891). *A. incana*, var. *hypochlora* sensu Fernald in Rhodora, xxiii. 257 (Feb. 27, 1922), not Callier (1918).—Low grounds, western Nova Scotia to northern Michigan, south to southern New England, locally to northern and eastern Pennsylvania and northern Indiana. The following, mostly distributed as *A. incana* and selected from more than 300 specimens before me, are characteristic. Nova Scotia: Cedar L., Digby Co., *Fernald & Long*, no. 23,781 (as *A. incana*, var. *hypochlora*); Eel L., Yarmouth Co., *F. & L.*, no. 23,782 (as *A. incana*, var. *hypochlora*). Maine: Milford, Penobscot Co., *Fernald & Long*, no. 13,474 (as *A. incana*, var. *hypochlora*); Rowe P., Pleasant Ridge, Somerset Co., Sept. 10, 1909, *J. F. Collins;* New Sharon, Franklin Co., July 23, 1904, *Knowlton* (as *A. serrulata*); Whitney P., Oxford, Oxford Co., July 12, 1914, *Weatherby;* Mud P., Greenwood, Oxf. Co., June 12, 1931, *Bill, Eaton, Fernald, Griscom & Hunnewell;* Washington, Knox Co., *J. G. Jack*, no. 3398 (as *A. incana*, var. *hypochlora*); Isle au Haut, Knox Co., Aug. 11, 1918, *Kidder* (as *A. incana*, var. *hypochlora*), *A. F. Hill*, no. 1652; Waterville, Kennebec Co., July 5, 1904, *Knowlton;* Livermore, Androscoggin Co., 1879, *Kate Furbish;* Baldwin, Cumberland Co., *Fernald & Long*, no. 13,476; Limington, York Co., *F. & L.*, no. 13,475; Cape Neddick, York Co., *J. G. Jack*, nos. 3388 and 3392. New Hampshire: Lebanon, Grafton Co., June 12, 1920, *Fernald, Hunnewell and R. W. Blanchard;* Hookset, Merrimac Co., Aug. 2, 1925, *C. F. Batchelder;* Durham, Strafford Co., Sept. 7, 1918, *Knowlton:* Derry, Rockingham Co., Aug. 25, 1917, *C. F. Batchelder;* Nashua, Hillsborough Co., *Robinson*, no. 800; Jaffrey, Cheshire Co., *Robinson*, no. 156. Vermont: Essex Junction, Chittenden Co., *S. F. Blake*, no. 2218; Middlebury, Addison Co., Sept. 25, 1880, *Brainerd* (as *A. serrulata*); West Rutland, Rutland Co., *Eggleston*, no. 3211; Townshend, Windham Co., June 2, 1912, *L. A. Wheeler;* Manchester, Bennington Co., *M. A. Day*, no. 163. Massachusetts: Emerson Point, Rockport, Essex Co., *L. B. Smith & R. G. Gates*, no. 1009; West Manchester, Essex Co., June 7, 1913, *F. T.*

Hubbard; Plum Island, Essex Co., *White & St. John*, nos. 528 and 543; Winchester, Middlesex Co., *Fernald & Bartlett*, no. 7; West Cambridge, Mid. Co., *F. & B.*, no. 2; Concord, Mid. Co., July, 1857, *E. S. Hoar;* Boxboro, Mid. Co., *Hubbard & Torrey*, no. 477; West Roxbury, Suffolk Co., April 9 and September 11, 1906, *F. F. Forbes* (as hybrid of *A. incana* and *A. rugosa*); Dorchester, Suf. Co., Sept. 23, 1919, *Kidder*, Brookline, Norfolk Co., March 19, Sept. 9 and Nov. 24, 1902, *F. F. Forbes;* Dedham, Norfolk Co., Sept. 8, 1895, *E. F. Williams;* Hanson, Plymouth Co., *Knobloch, Smith & Stebbins*, no. 2562; North Tisbury, Martha's Vineyard, Dukes Co., Oct. 3, 1912, *Bicknell;* Copaum P., Nantucket, Nant. Co., June 8, 1908, *Bicknell;* Hardwick, Worcester Co., Aug. 9, 1935, *C. F. Batchelder;* Sutton, Worc. Co., *Anderson, Smith & Weatherby*, no. 2446; Montague, Franklin Co., May 11, 1912, *Wheeler & Wiegand;* Chicopee, Hampden Co., *Murdoch & Torrey*, no. T 435; Smith's Ferry, Northampton, Hampden Co., Aug. 10, 1912, *F. F. Forbes;* Proven Mt., Agawam, Hampden Co., May 18, 1913, *Knowlton & White;* North Adams, Berkshire Co., May 14, 1915, *Knowlton;* Lenox, Berks. Co., Aug. 24, 1902, *Hoffmann;* Centre P., Becket, Berks. Co., Sept. 22, 1904, *Hoffmann;* Mount Washington, Berks. Co., Sept. 10, 1915, *Floyd*. RHODE ISLAND: Cumberland, Providence Co., May 30, 1911, *Knowlton;* East Providence, Prov. Co., *J. F. Collins*, no. 15,010. CONNECTICUT: Middlebury, New Haven Co., April 25 and July 16, 1897, *Shepardson;* Oxford, N. H. Co., April 12, 1888 and Sept. 17, 1897, *Harger*. NEW YORK: Black Lake, St. Lawrence Co., *Fernald, Wiegand & Eames*, no. 14,251; Canton, St. L. Co., *Phelps*, no. 373; Sandy Creek Township, Oswego Co., *Fernald, Wiegand & Eames*, nos. 14,249 and 14,250; Spruce P., Black Lake Forest, Orange Co., *Raup*, no. 7589; Taughannock Ravine, Ulysses, Tompkins Co., *Eames & Wiegand*, no. 11,930. PENNSYLVANIA: Kenney's P., e. of West Auburn, Susquehanna Co., *Wahl*, no. 489; 7 miles s. of Moscow, Lackawanna Co., *Randolph & Randolph*, no. 57; Martic Forge, Lancaster Co., Aug. 16, 1914, *J. F. Collins;* Crawford Co., *Dickey*, no. 23. MICHIGAN: Isle Royale, Keweenaw Co., *Cooper*, no. 7; Keweenaw Co. (without stated localities), Oct., 1904, *Farwell* (some as *A. incana*, var. *americana*, some as var. *glauca*); north of St. Ignace, Mackinac Co., *Benner*, no. 6715. INDIANA: south of Tamarack, Porter Co., *Deam*, no. 8064.—Spread from cultivation in Europe. PLATES 977–979.

Var. TYPICA, forma **Emersoniana,** f. nov. (TAB. 979, FIG. 4), foliis subtus piloso-tomentulosis, pilis plus minusve rufescentibus. —*A. incana* sensu Emerson, Trees and Shrubs in Mass. i. 251, with plate (1875), not (L.) Moench.—Differing from typical *A. rugosa* in having a permanently and usually densely pilose-tomentulose lower surface, the pubescence mostly ferruginous.

Of essentially the same range but forming individual and constant large colonies. The following, selected from thrice as many sheets, are characteristic. NOVA SCOTIA (all distrib. as *A. incana*, var. *hypochlora*): Lahave R., Bridgewater, Lunenburg Co., *Fernald & Long*, no. 23,779; Wallace Lake, Italy Cross, Lun. Co., *F. & L.*, no. 23,780; Sloane L., Pleasant Valley, Yarmouth Co., *Fernald, Bissell, Graves, Long & Linder*, no. 21,015. MAINE: Fairfield, Somerset Co., *Fernald & Long*, no. 13,472; Pembroke, Washington Co., *Fernald*, no. 1700; Burnham, Waldo Co., July 24, 1940, *Knowlton;* Nequasset L., Woolwich, Sagadahoc Co., *Fernald & Long*, no. 13,477; Cape Elizabeth, Cumberland Co., *Chamberlain*, no. 682; Limington, York Co., *Fernald & Long*, nos. 13,475, 13,479 and 13,480; Alfred, York Co., *F. & L.*, no. 13,478; Wells, York Co., *F. & L.*, no. 13,467; York Harbor, York Co., Aug., 1892, *Bicknell* (with unpublished new specific name). NEW HAMPSHIRE: Haverhill, Grafton Co., *Fernald*, no. 15,525; Mason, Hillsborough Co., Aug. 20, 1917, *C. F. Batchelder;* Dover, Strafford Co., *Hodgdon*, no. 2567; Hampton Falls, Rockingham Co., Sept. 10, 1916, *C. F. Batchelder;* Derry, Rock. Co., Aug. 15, 1926, *Batchelder;* Hinsdale, Cheshire Co., Aug. 23, 1919, *Batchelder*. VERMONT: Milton, Chittenden Co., July 25, 1927, *Knowlton;* Hartford, Windsor Co., June 12, 1920, *Eaton & St. John;* Wallingford, Rutland Co., May 30, 1907, *Kennedy*. MASSACHUSETTS: Lynnfield, Essex Co., *Fernald & Bartlett*, no. 786; Round Pond, Tewksbury, Middlesex Co., April 14 and Oct. 14, 1906, *M. L. Fernald & H. H. Bartlett*, nos. 14 (TYPE in Herb. Gray.) and 18; Fresh Pond, Cambridge, Mid. Co., 1842 or 43, *Asa Gray* (sheet sent to and identified by Regel as "*Alnus serrulata* Willd., β. *rugosa*"); West Cambridge, *Fernald & Bartlett*, no. 4; West Roxbury, Suffolk Co., March 25, April 5 and May 28, 1904, *F. F. Forbes;* Brookline, Norfolk Co., Oct. 11, 1914, *F. F. Forbes;* Milton, Norf. Co., March 26 and May 26, 1921, *Kidder;* Hanson, Plymouth Co., Aug. 30, 1941, *Knowlton;* Gunning P., Falmouth, Barnstable Co., *Fernald*, no. 578; Dennis P., Yarmouth, Sept. 19, 1913, *Fernald & Long*, as *A. noveboracensis;* Lambert Cove, Martha's Vineyard, Dukes Co., *Bicknell*, no. 3432; Great P., Martha's Vineyard, *Bicknell*, no. 3143 (as *A. noveboracensis*); Nantucket, *Bicknell*, no. 3438; Leominster, Worcester Co., *Fernald & Bean*, no. 14,017; Princeton, Wor. Co., July 22, 1913, *Weatherby;* Barre, Wor. Co., May 14, 1915, *Hunnewell, Macbride & Torrey;* Northfield, Franklin Co., May 11, 1912, *Fernald & Floyd;* Longmeadow, Hampden Co., May 18, 1913, *Hill & St. John;* Chester, Hampd. Co., May 17, 1913, *Weatherby & Bean;* Worthington, Hampshire Co., *B. L. Robinson*, no. 812; Adams, Berkshire Co., *Knowlton & Bean*, no. 15,107. RHODE ISLAND: Newport, N. Co., *Mearns*, no. 603. CONNECTICUT: Woodstock, Windham Co., July 31, 1919, *Weatherby;*

Pomfret, Wind. Co., July 4, 1901, *Driggs;* Franklin, New London Co., Aug. 27 and Nov. 21, 1912, *Woodward;* Sprague, N. L. Co., Sept. 3, 1913, *Woodward;* Tyler P., Goshen, Litchfield Co., *Weatherby*, no. 3350. NEW YORK: Bear P., French Mt., Warren Co., June 9, 1920, *Burnham;* Long L., Hamilton Co., *House*, no. 10,172; Mud Pond, Oswego, O. Co., *Fernald, Wiegand & Eames*, no. 14,246. MICHIGAN: Douglas L., Cheboygan Co., *Ehlers*, no. 534. INDIANA: Tremont, Porter Co., Sept. 9, 1920, *D. C. Peattie.*

The extreme with soft-pubescent lower leaf-surfaces, *Alnus rugosa*, forma *Emersoniana*, is named for that remarkably accurate and unexcelled student of Massachusetts trees and shrubs, GEORGE BARRELL EMERSON (1797–1881), author of the scholarly Report on the Trees and Shrubs in Massachusetts (2 vols., 1875), a famous and greatly honored educator, an intimate of Jacob Bigelow, adviser of Horace Mann, and one of the three trustees of the Arnold bequest which, as a result of his guidance, became the initial fund of the Arnold Arboretum. Emerson clearly understood and first discriminatingly stated the strong specific differences which separate the northern *Alnus rugosa* and the southern *A. serrulata.* These he accurately illustrated but, like every one of his period and up to the present, he did not get away from the conviction that our dark-barked shrub is identical with the whitish-barked tree of Europe. Although in Trees and Shrubs in Mass. i. 248 he definitely wrote "White Alder of Europe is a very beautiful tree, sometimes rising to the height of seventy feet", on p. 251 he began his very accurate account of "THE SPECKLED ALDER. *A. incana*, Willdenow", "easily distinguished by the brilliant, polished, reddish green color of its stem-bark", "speckled with conspicuous light gray dots", "The stem is usually eight or ten feet high and from one to three inches in diameter".

Emerson distinguished three variations of the Speckled Alder: (1) what he considered typical, with "leaves . . . broad oval, rounded or somewhat cordate at base . . . , doubly serrate or denticulate-serrate . . . smooth and conspicuously impressed at the veins and veinlets above; of a soft coriaceous texture; covered with abundant, soft, often ferruginous pubescence beneath, with the veins and veinlets strikingly prominent" (*A. rugosa*, forma *Emersoniana*); (2) *A. glauca* Michx.:

"A striking and very beautiful variety of the speckled alder, called the glaucous alder by the younger Michaux, is distinguished by the pale blue or glaucous color of the lower surface of the leaves. The pubescence is less abundant, but the veins and footstalk are often, as in the common form [i. e. *A. rugosa*, forma *Emersoniana*] of the tree, of a rusty color"; and (3) a series which Emerson considered "intermediate between the common [*A. serrulata*] and the glaucous alder . . . It differs from the common alder in its leaves being always acute and never obovate, and from the speckled, in having its leaves shining and free from down . . . The general aspect of this alder is similar to that of the speckled alder, differing in the greenness of the under surface of the leaves". Emerson's third variety was, apparently, a mixture of typical *A. rugosa* and the extreme of *A. serrulata* with subelliptic and round-based leaves.

Var. **americana** (Regel), comb. nov. *A. incana*, β. *americana* Regel in Nouv. Mém. Soc. Nat. Mosc. xiii. 155—repr. as Mon. Bet. 97 (1861); H. Winkl. in Engler, Pflanzenr. iv[61]. 123 (1904). *A. glauca* Michx. f. Hist. Arb. Forest. Am. Sept. iii. 320, t. 4, fig. 2 (1813). *A. incana*, var. *glauca* (Michx. f.) Loudon, Arbor. Brit. iii. 1688 (1838) pro parte, excl. citation of Ait.; Gray, Man. ed. 2: 412 (1856); Callier in Mitteil. Deutsche Dendr. Gesellsch. 1918: 143 (1918)[1], not Ait. Hort. Kew. ed. 2, v. 259 (1813). *A. incana*, α. *vulgaris* Spach in Ann. Sci. Nat. sér. 2, xi. 206 (1841) in small part only (*A. glauca* Michx. fil), excluding the synonyms "*Alnus incana* auctor", "*Alnus undulata* Pursh" (Pursh correctly giving *A. undulata* Willd. as a synonym of *A. crispa* Ait.) and "Foliis . . obovatis". *A. incana* sensu Tuckerm. in Am. Journ. Sci. xlv. 32 (1843) and most later Am. auth., not (L.) Moench. *A. americana* (Regel) Hort. ex K. Koch, Dendrol. ii[1]. 636 (1872).—Generally more northern in range, Labrador to Hudson Bay region and Saskatchewan, south to Newfoundland, Nova Scotia, Maine, New Hampshire, Massachusetts, uplands of Pennsylvania, Maryland and West Virginia, northern Ohio, northern Indiana, Wisconsin and northeastern Iowa. The following, selected from nearly 200 sheets before me, are characteristic. LABRADOR: Paradise R., Sandwich Bay (lat. 53° 30′, long. 57° 15′), *Harlow Bishop*, no. 275. NEWFOUNDLAND: Clarenville, July 30, 1938, *Agnes M. Ayre;* Quarry, *Fernald &*

[1] Callier showed the usual Germanic lack of understanding of American geography, citing one specimen from "D a k o t a: New Anglia leg. Blake" and Mrs. Chase's no. 2105 from Dune Park, Indiana, as from "M i c h i g a n: Lake Michigan, Done Park". On a preceding page the strictly northeastern *A. rugosa* was cited from anywhere, including California.

Wiegand, no. 5302; Grand Falls, *F. & W.*, no. 5301; near mouth of Badger Brook, *Robinson & Schrenk*, no. 35; Little Red Indian Lake, *F. & W.*, no. 5300; Goose P., *F. & W.*, no. 3276; Winterhouse Brook, Bonne Bay, *Fernald, Long & Fogg*, no. 1647; Summerside, Bay of Islands, *F. & W.*, no. 3277; Table Mt., Port-à-Port Bay, *Fernald & St. John*, no. 10,828. QUEBEC: Natashquan R., Saguenay Co., July, Aug., 1912, *C. W. Townsend;* Piashtibaie, Sag. Co., *St. John*, no. 90,395; Seven Islands, Sag. Co., *C. B. Robinson*, no. 900; Douglastown, Gaspé Co., Aug. 22, 1904, *Collins, Fernald & Pease;* R. Ste. Anne des Monts, Gaspé Co., *Fernald & Collins*, no. 217; Bonaventure R., Bonav. Co., Aug. 4–8, 1904, *C. F. & P.;* Matane, M. Co., Aug. 5, 1904, *F. F. Forbes;* Bic, Rimouski Co., *Rousseau*, no. 21,457; Cap-à-l'Aigle, Charlevoix Co., *J. Macoun*, no. 68,768; Lac Tremblant, Terrebonne Co., July 23, 1922, *Churchill;* Black Lake, Megantic Co., *Fernald & Jackson*, no. 12,076; Georgeville, Stanstead Co., Aug. 22, 1914, *Churchill;* East Main, E. Coast of James Bay, *D. Potter*, no. 265; Rupert House, E. Coast, *Potter*, no. 260. MAGDALEN ISLANDS: Brion Island, *St. John*, no. 1847; Ile de l'Étang-du-Nord, *Victorin & Rolland*, no. 9418; Grindstone I., *Fernald, Bartram, Long & St. John*, no. 7310. NEW BRUNSWICK: Kent Co., 1870, *Fowler*. NOVA SCOTIA: Pottle's L., North Sydney, Cape Breton Co., *Bissell & Linder*, no. 21,020; Glenbard, near James River Sta., Antigonish Co., *Perry, Wetmore, Hicks & Prince*, no. 10,256; Musquodoboit Harbor, Halifax Co., *Rousseau*, no. 35,263; Deception L., Shelburne Co., *Fernald & Long*, no. 23,777; Clyde River, Shelb. Co., *J. G. Jack*, no. 3454; Butler's L., Gavelton, Yarmouth Co., *Fernald, Long & Linder*, no. 21,021; Lake Annis, Yarm. Co., *Bissell, Pease & Linder*, no. 21,017; Journeay L., Weymouth, Digby Co., *Fernald & Long*, no. 23,778. MAINE: Fort Kent, Aroostook Co., *Fernald*, no. 2446; Masardis, Aroost. Co., *Fernald;* no. 2447; Orono, Penobscot Co., May 30, 1904, *Fernald;* Foxcroft, Piscataquis Co., Aug. 31, 1897, *Fernald;* St. John P., Township iv, Range 17, Somerset Co., *St. John & Nichols*, no. 2272; Dead River, Som. Co., *Fernald & Strong*, no. 409, in part; Chesterville, Franklin Co., Aug. 28, 1904, *E. B. Chamberlain;* Calais, Washington Co., Aug. 24, 1928, *Knowlton;* Roque Bluff, Wash. Co., July 31, 1918, *Knowlton;* Northfield, Wash. Co., Aug. 2, 1941, *Knowlton;* Nicatous L., Twp. 3, Hancock Co., *Fassett*, no. 2378; Seal Harbor, Hanc. Co., July 8, 1889, *Redfield;* Brooklin, Hanc. Co., *A. F. Hill*, no. 1051; Isle au Haut, Knox Co., Aug. 26, 1927, *Kidder;* Monhegan I., Lincoln Co., Aug., 1911, *Kate Furbish;* Brunswick, Cumberland Co., Aug. 26, 1910, *Kate Furbish;* Baldwin, Cumb. Co., *Fernald & Long*, no. 13,470; North Berwick, York Co., Aug. 31, 1894, *Parlin*. NEW HAMPSHIRE: White Mountains, Tuckerman, labeled, "*Alnus incana*, Willd. *A. glauca*, Michx. f. species unica", with reference

to Tuckerman's treatment in Am. Jour. Sci. xlv. 32 (1845), this sheet marked by Regel *A. incana* β. *glauca;* Lake Umbagog, Cambridge, Coös Co., *Pease*, no. 18,150; Pittsburg, Coos Co., *Pease*, no. 10,297; summit of Cape Horn, Northumberland Co., Coös Co., *Pease*, no. 16,451; Jackson, Carroll Co., Aug. 1895, *E. W. Hervey;* Bow, Merrimack Co., Sept. 21, 1930, *G. M. Bryant;* Hillsborough, H. Co., Sept. 2, 1921, *C. F. Batchelder;* New Hampton, Belknap Co., Sept. 5, 1904, *F. F. Forbes;* Richmond, Cheshire Co., Aug. 21, 1919, *C. F. Batchelder;* Cheshire Co., *Robinson*, no. 156. VERMONT: Brunswick Springs, Essex Co., *S. N. F. Sanford*, no. 1083; Willoughby, Orleans Co., July, 1898, *Kennedy:* Worcester, Washington Co., Aug. 25, 1875, *Blanchard;* Charlotte, Chittenden Co., April 15 and Sept. 29, 1879, *Pringle;* Hartland, Windsor Co., *J. G. Underwood*, no. 3116. MASSACHUSETTS: Lexington, Middlesex Co., March 23 and May 20, 1931, *L. B. Smith;* Buckland, Franklin Co., April 11 and Aug. 19, 1904, *F. F. Forbes;* Worthington, Hampshire Co., *B. L. Robinson*, no. 507; Pittsfield, Berkshire Co., Aug. 5, 1915, *Churchill.* NEW YORK: Norfolk, St. Lawrence Co., *Phelps*, nos. 1139–1141; Selkirk, Oswego Co., *Fernald, Wiegand & Eames*, no. 14,245; Canadice, Ontario Co., *C. C. Thomas*, no. 3926; Penn Yan, Gates Co., *Sartwell* (Sartwell Herb., Hamilton College, presumable duplicate of the TYPE of *A. incana* β. *americana* Regel); western New York, *Asa Gray*, identified by Regel as *A. incana*, var. *glauca.* PENNSYLVANIA: Little Mud P., e. of Porter's L., Pike Co., *Fogg*, no. 10,767; Pocono Plateau, Monroe Co., July, Aug., 1904, *Harshberger.* MARYLAND: s. of Finzel, Garrett Co., Aug. 15, 1936, *Wherry.* WEST VIRGINIA: at 2500 ft. alt., e. of Gormannia, Grant Co., *Svenson*, no. 4439. ONTARIO: Lake Rosseau, Muskoka Co., *W. F. Wright*, no. 140; Moose River, James Bay, Nipissing Distr., *David Potter*, nos. 262–264; Sand Point, Algoma Distr., *Taylor et al.* no. 842; Batchawana R., Alg. Distr., *Taylor et al.* no. 839; Nipigon, Thunder Bay Distr., *Jennings & Daily*, no. 481. MICHIGAN: Baraga, B. Co., *Fernald & Pease*, no. 3081. OHIO: Hiram, Portage Co., *R. J. Webb*, no. 1377. INDIANA: Chesterton, Porter Co., Aug. 12, 1925, *Churchill.* WISCONSIN: Kewaunee, K. Co., Aug. 2, 1902, *Schuette;* Brodhead, Green Co., *Fassett*, no. 12,931; Dayton, Green Co., *Fassett*, no. 13,990; Brown Co., 1880, *Schuette.* MINNESOTA: Sect. NW.-SW. 35, T. 144, R. 36, Clearwater Co., *M. L. Grant*, no. 3368; Cass L., Cass Co., *Pammel*, no. 5; Centre City, Chisago Co., July, 1892, *B. C. Taylor;* Bembridge, *Pammel*, no. 892. IOWA: Postville, Allamakee Co., June, 1914, *Schultz, Pammel & Orr;* Bluffton, Winneshiek Co., March 28 and Sept. 16, 1903, *Shimek;* New Hampton, Chickasaw Co., *Pammel*, no. 475. PLATES 980 and 981.

Var. AMERICANA, forma **tomophylla** (Fernald), comb. nov. *A. incana*, var. *glauca*, f. *tomophylla* Fernald in RHODORA, xvi. 56 (1914). *A. incana*, var. *tomophylla* (erroneously attributed to Fernald) by Rehder, Man. Cult. Trees and Shrubs, 147 (1927).—Local. NEWFOUNDLAND: Norris Arm, *Fernald & Wiegand*, no. 5303 (TYPE). MAINE: Hartford, Oxford Co., Aug., 1892, *Parlin*. PLATE 982, FIG. 4.

Var. AMERICANA, forma **hypomalaca,** f. nov. (TAB. 982, FIG. 1–3), foliis subtus molliter persistenterque piloso-tomentulosis, pilis cinereis.—Local, often abundant, through much of the area of var. *americana*. QUEBEC: Pointe du Lac, St. Maurice Co., Aug. 2, 1923, *Chamberlain & Knowlton*. NEW BRUNSWICK: Shediac Cape, Westmoreland Co., July 3, 1914, *F. T. Hubbard;* Seal Cove Brook, Grand Manan, Charlotte Co., July 24, 1941, *C. A. & Una F. Weatherby*, no. 7015 (TYPE in Herb. Gray.). PRINCE EDWARD ISLAND: St. Charles, Kings Co., *Fernald & St. John*, no. 11,030. NOVA SCOTIA: Central Port Mouton, *Fernald, Bissell, Graves, Long & Linder*, no. 21,019; Meteghan, Digby Co., *Fernald & Long*, no. 21,016; Middleton, Annapolis Co., *Fernald, Pease & Long*, no. 21,018. MAINE: Houlton, Aroostook Co., Aug. 26, 1897, *Fernald;* Patten, Penobscot Co., Aug. 23, 1897, *Fernald;* Milford, *Fernald & Long*, nos. 13,468 and 13,469; Fryeburg, Oxford Co., *C. E. Faxon;* Cutler, Washington Co., July 1, 1902, *Kennedy et al.;* Pembroke, Wash. Co., *Fernald*, no. 1699; Dedham, Hancock Co., *Fernald & Long*, no. 13,465; Deer Isle, Hanc. Co., *A. F. Hill*, no. 2096; Atlantic, Swans Island, Hanc. Co., *Hill*, no. 2281; Rockport, Knox Co., *Rossbach*, no. 1207; Nequasset L., Woolwich, Sagadahoc Co., *Fernald & Long*, no. 13,477; Leeds, Androscoggin Co., July 23, 1913, *Knowlton;* Falmouth, Cumberland Co., *Chamberlain & Bissell*, no. 389; Limington, York Co., *Fernald & Long*, nos. 13,479 and 13,480; Alfred, York Co., *F. & L.*, no. 13,466; Kennebunkport, York Co., Aug. 1929, *C. A. Cheever*. NEW HAMPSHIRE: Mt. Washington, Coös Co., July 16, 1891, *Kennedy:* Randolph, Coös Co., *Pease*, no. 11,179; Shelburne, Coös Co., *Pease*, no. 11,133; Jackson, Carroll Co., July 12, 1883, *C. W. Jenks;* Warren, Grafton Co., July 24, 1908, *E. F. Williams;* Merrimack, Hillsborough Co., Aug. 11, 1917, *C. F. Batchelder;* Rindge, Cheshire Co., May 30, 1912, *F. F. Forbes*. VERMONT: Stowe, Lamoille Co., July 27, 1884, *C. W. Swan*. MASSACHUSETTS: Round Pond, Tewksbury, Middlesex Co., *Fernald & Bartlett*, no. 15; Beaver Brook Reservation, Mid. Co., May 26, 1894, *G. L. Chandler;* Brookline, Norfolk Co., Sept. 25, 1905, *F. F. Forbes;* Needham, Norf. Co., *T. O. Fuller;* Springfield, Hampden Co., June 17, 1913, *Luman Andrews;* Cheshire, Berkshire Co., July, 1912, *E. J. Winslow;* Sheffield, Berks. Co., July 24, 1912, *Hoffmann*. NEW YORK: Axton, Franklin Co., July 10,

1899, *Rowlee, Wiegand & Hastings;* Conklingville, Saratoga Co., *Fogg*, no. 15,161. ONTARIO: Kokoko Bay, Timagami Region, *Edgar & Dorothy M. Anderson*, no. 26,045B; Stokes Bay, Bruce Peninsula, *Krotkov*, no. 8948. INDIANA: Dune Park, Porter Co., *Greenman*, no. 2683.

Alnus rugosa, vars. *typica* and *americana* are not mere forms, the former with green to rufescent lower leaf-surfaces, the latter with them glaucous, gray or cinereous. The latter is decidedly more northern in range. I am indebted to Professor Rehder and Dr. A. C. Smith for the use of a Sartwell sheet from Penn-Yan, New York, lent by the Herbarium of Hamilton College. This is presumably part of the original collection upon which Regel founded his *A. incana*, β. *americana*. The approximately 400 sheets showing foliage in the Gray Herbarium and the herbarium of the New England Botanical Club, when tabulated, give the following proportions (in percentages).

LABRADOR PENINSULA, var. *typica* 0, var. *amer.* 100%; NEWFOUNDLAND, var. *typica* 0, var. *amer.* 100; QUEBEC (south of Lab. Pen.), var. *typica* 0, var. *amer.* 100; NEW BRUNSWICK, var. *typica* 0, var. *amer.* 100; NOVA SCOTIA, var. *typica* 43, var. *amer.* 57; NORTHERN MAINE (northern tier of counties), var. *typica* 59, var. *amer.* 41; SOUTHERN MAINE, var. *typica* 80, var. *amer.* 20; Coös Co., NEW HAMPSHIRE, var. *typica* 5, var. *amer.* 95; REST OF NEW HAMPSHIRE, var. *typica* 65, var. *amer.* 35; VERMONT, var. *typica*, 62, var. *amer.* 38; MASSACHUSETTS, var. *typica* 89, var. *amer.* 11; RHODE ISLAND, var. *typica* 100, var. *amer.* 0; CONNECTICUT, var. *typica* 100, var. *amer.* 0.

The variations which I treat as forms show no such geographic concentrations; they are scattered throughout the range of the variety under which they are placed.

2. A. SERRULATA (Ait.) Willd. Sp. Pl. iv[1]. 336 (1805).—The following varieties and forms are recognized.

a. Principal leaves definitely obovate, cuneate, or subcuneate to subacute at base; those of vigorous 1st. year's shoots obtuse or acute; those of fertile branches of 2nd. year one third to two thirds as broad as long.
  Lower surfaces of mature leaves glabrous or strongly glabrescent.....Var. *vulgaris*.
  Lower surfaces of mature leaves permanently and densely pilose-tomentulose, plush-like to touch.....Forma *noveboracensis*.

a. Principal leaves broadly elliptic-obovate to broadly oblong-elliptic or subrotund (though broadest at or above the middle), gradually rounded at base; those of fertile branches of 2nd. year mostly three fifths to nine tenths as broad as long....*b.*

b. Lower surfaces of mature leaves glabrous or strongly glabrescent.

Leaves gradually rounded to subacute (or more rarely acute) at apex, mostly 6–15 cm. long; staminate aments 3–7 cm. long. . . . . Var. *subelliptica*.
Leaves broadly retuse or emarginate at apex, mostly 2–5 cm. long; staminate aments 2 cm. long. . . . . Forma *emarginata*.

b. Lower surfaces of mature leaves permanently and densely pilose-tomentulose, plush-like to touch.
Large shrub or small tree; principal leaves 6–12 cm. long; mature cones 1–2 cm. long; staminate aments 3–7 cm. long. . . . . Forma *mollescens*.
Dwarf shrub 0.5–1 m. high; principal leaves 2–5 cm. long; mature cones 6–12 mm. long; staminate aments 1.3–1.8 cm. long. . . . . Forma *nanella*.

A. SERRULATA, var. VULGARIS Spach in Ann. Sci. Nat. sér. 2, Bot. xv. 206 (1841), in part ("Foliis . . . lanceolato-obovatis, v. obovatis, v. oblongo-obovatis, saepius obtusis v. vix acuminatis, basi cuneatis"). *Betula-Alnus rubra* Marsh. Arb. Am. 20 (1785), presumably. *Betula serrulata* Ait. Hort. Kew. iii. 338 (1789); Willd. Berlin. Baumzucht, 45 (1796), at least as to citation of Ait. *A. serrulata* (Ait.) Willd. Sp. Pl. iv[1]. 336 (1805). *A. rubra* (Marsh.) Tuckerm. in Am. Journ. Sci. xlv. 32 (1843), not Bong. (1833). *A. glutinosa*, δ. *serrulata* (Ait.) Regel in Nouv. Mém. Soc. Nat. Mosc. xiii. 164, t. xi. fig. 7—repr. as Mon. Bet. 106, t. xi. fig. 7 (1861), in part, incl. basonym. *A. glutinosa*, δ. *serrulata*, lusus a. *genuina* Regel, l. c. fig. 6 (1861). *A. glutinosa*, δ. *serrulata*, lusus b. *obtusifolia* Regel, l. c. fig. 7 (1861). *A. serrulata*, α. *genuina* Regel in DC. Prodr. xvi[2]. 188 (1868), in part. *A. serrulata*, δ. *obtusifolia* Regel, l. c. (1868). *A. rugosa* sensu K. Koch, Dendrol. ii. 635 (1872); sensu Coulter in Mem. Torr. Bot. Cl. v. 131 (1894); sensu Sargent, Silva, ix. 69 (1896) and subseq. auth.; not Spreng. (1825). *A. rugosa*, var. *serrulata* (Ait.) H. Winkler in Engler, Pflanzenr. iv[61]. 120 (1904). *A. rugosa*, var. *obtusifolia* (Regel) H. Winkler, l. c. (1904). *A. serrulata pumila* Dameker in Mitt. Deutsch. Dendr. Ges. 1909: 326 (1909).—Northern Florida to Louisiana, north to southwestern Nova Scotia, central and southern Maine, southern New Hampshire, central Vermont, New York, West Virginia, Ohio, Indiana, Illinois, Missouri and southeastern Oklahoma. The following, selected from many hundreds of sheets, are characteristic. NOVA SCOTIA: Ponhook L., Queen's Co., *Weatherby*, no. 6955: Cameron L., South Brookfield, Queen's Co., *C. A. & Una F. Weatherby*, no. 7059. MAINE: North P., Norway, Oxford Co., *Pease*, no. 24,100; near Jordan P., Mt. Desert I., Hancock Co., *Stebbins*, no. 235; Bristol, Lincoln Co., *E. B. Chamberlain*, no. 716; South Poland, Androscoggin Co., 1893, *Kate Furbish;* Wilson's Mill, Cumberland, C. Co., *Chamberlain, Morris & Ricker*, no. 852; Limington, York Co., *Fernald & Long*, no. 13,481; Cape Neddick, York Co., *J. G. Jack*, no. 3394. NEW HAMPSHIRE: Wild Goose P., Strafford, S. Co., *Hodgdon & Cham-*

berlain, no. 2886; Nottingham, Rockingham Co., *A. A. Eaton*, no. 435; Danville, Rock. Co., *Pease*, no. 28,210; Manchester, Hillsborough Co., Oct. 2, 1896, *F. W. Batchelder;* Walpole, Cheshire Co., *Fernald*, no. 505; Sandy P., Richmond, Chesh. Co., Sept. 3, 1916, *C. F. Batchelder*. VERMONT: L. St. Catherine, Wells, Rutland Co., *Dodge & Fassett*, no. 822. MASSACHUSETTS: Andover, Essex Co., *Pease*, no. 3432; Ashby, Middlesex Co., May 30, 1914, *Knowlton;* Concord, Mid. Co., April 4 and July 20, 1858, *E. S. Hoar;* Wilmington, Mid. Co., *Fernald & Bartlett*, no. 9; West Roxbury, Suffolk Co., Aug. 9 and Sept. 9, 1904, *F. F. Forbes;* Blue Hills Reserv., Aug. 11, 1895, *E. F. Williams;* Lakeville, Plymouth Co., *Fernald & Long*, no. 9345; Prospect Hill P., Taunton, Bristol Co., *F. C. Seymour*, no. 4460; Brewster, Barnstable Co., *Fernald*, no. 16,684; Provincetown, Barns. Co., *Fernald & Long*, no. 18,356; Chilmark, Martha's Vineyard, Dukes Co., *F. C. Seymour*, no. 1671; Harvard, Worcester Co., Aug. 6, 1916 and April 22, 1917, *F. F. Forbes;* Gill, Franklin Co., May 11, 1912, *St. John & Weatherby;* Ware, Hamshire Co., *Goodale, Potsubay & St. John*, no. 64,660; Stockbridge, Berkshire Co., Aug. 6, 1917, *Hoffmann*. RHODE ISLAND: Lincoln, Providence Co., *St. John*, no. 894: Barrington, Bristol Co., May 20, 1911, *E. J. Winslow;* Warren, Bristol Co., July 25, 1919, *Sanford;* Prudence I., Newport Co., *Sanford*, no. 10,377; Richmond, Washington Co., Aug. 30, 1919, *Fernald & Collins;* Hopkinton, Wash. Co., Sept. 1, 1919, *Fernald, Woodward & Collins*. CONNECTICUT: Woodstock, Windham Co., *Weatherby*, no. 4519; Franklin, New London Co., Oct. 4, 1913, *Woodward;* Tolland, T. Co., *Weatherby*, no. 5330; Tariffville, Hartford Co., May 17, 1913, *Winslow & Hill;* North Guilford, New Haven Co., July 11, 1904, *W. R. Dudley*. NEW YORK: West Fort Ann, Washington Co., Aug. 17, 1913, *Dobbin & Burnham;* Ballston L., Saratoga Co., Aug. 11, 1906, *Burnham;* Sutherland P., Black Lake Forest, Orange Co., *Raup*, no. 7746; Fishers Island, Suffolk Co., *St. John*, no. 2683; Sandy Creek Township, Oswego Co., *Fernald, Wiegand & Eames*, no. 14,248; Ithaca, Tompkins Co., *MacDaniels*, no. 3928. NEW JERSEY: Oradell, Bergen Co., April 16 and Oct. 8, 1905, *Mackenzie;* Denville, Morris Co., Aug. 13, 1905, *Mackenzie;* Vincetown, Burlington Co., *Long*, no. 11,091; Pleasantville, Atlantic Co., *Tidestrom*, no. 11,377; Friendship, Salem Co., *Long*, no. 51,606. PENNSYLVANIA: Scotrun, Monroe Co., Aug., 1906, *B. Long;* Chester Co., *Sharpless*, no. 276; Smithfield Swamp, Lancaster Co., Aug. 30, 1889, *Heller;* Mifflinville, Columbia Co., *Fogg*, no. 14,537; Farrandsville, Clinton Co., *Fogg*, no. 11,516; Fayette Co., *Dickey*, nos. 21 and 205. DELAWARE: Cool Spring, Sussex Co., *Larsen*, no. 459. MARYLAND: Chesapeake City, Cecil Co., *Tidestrom*, no. 11,679; St. Mary's Co., *Tidestrom*, no. 5062. DISTRICT OF COLUMBIA: Brookland, Oct. 15, 1898,

Holm; Terra Cotta, Aug. 18, 1915, *Holm.* WEST VIRGINIA: Huttonsville, Randolph Co., *Greenman*, no. 330; Tygart Junction, Barbour Co., *Greenman*, no. 329; between Gilmer and Read, Gilmer Co., *Greenman*, no. 331. VIRGINIA: se. of Alexandria, Fairfax Co., *Wiegand & Manning*, no. 958; ne. of Mechanicsville, Louisa Co., *Adams & Wherry*, no. 2228; Capital Landing Creek, York Co., *Mentzel*, no. 145; Oceana, Princess Anne Co., *Fernald & Long*, nos. 3896 and 3897; eastern shore, Lake Drummond, Norfolk Co., *J. Arthur Harris*, no. C 18,233; Zuni, Isle of Wight Co., *Fernald, Griscom & Long*, no. 6582; south of South Quay, Nansemond Co., *F. & L.*, no. 11,559; south of Franklin, Southampton Co., *F. & L.*, no. 8235; e. of Dan River, Halifax Co., *Fosburg*, no. 15,383; Hollins School, Roanoke Co., *C. E. Wood, Jr.*, no. 5483; "Mts., Virg. 1843", *Asa Gray* (type of var. *obtusifolia* Regel, in Gray Herb.); Bane, Giles Co., *Fogg*, no. 14,714, as *A. crispa;* Peak Creek, Pulaski Co., at 2200 ft. alt., July 16, 1892, *Small.* NORTH CAROLINA: Snow Hill, Greene Co., *L. F. & F. R. Randolph*, no. 776; Clinton, Sampson Co., *Godfrey*, no. 5895; Biltmore, Buncombe Co., *Bilt. Herb.* no. 1240[b]; at 4000 ft. alt., Pisgah Forest, Transylvania Co., *House*, no. 4041; at 1700 ft. alt., Great Smoky Mts., Swain Co., July, 1891, *Beardslee & Kofoid.* SOUTH CAROLINA: s. of Myrtle Beach, Horry Co., *Weatherby & Griscom*, no. 16,511; Georgetown, G. Co., *Godfrey & Tryon*, no. 988; Santee Canal, *Ravenel* (identified by Regel as his var. *genuina*); Summerville, Dorchester Co., *B. L. Robinson*, no. 114; se. of Elloree, Orangeburg Co., *Godfrey & Tryon*, no. 1503. GEORGIA: se. of Ludowici, Long Co., *Wiegand & Manning*, no. 962; s. of Cuthbert, Randolph Co., *Harper*, no. 1782. FLORIDA: River Junction, Gadsden Co., *Nash*, no. 2590; Peters Creek, Clay Co., *Small & DeWinkeler*, no. 9706. INDIANA: s. of Chestnut Ridge, Jackson Co., *Deam*, no. 13,740. KENTUCKY: Keyser Creek, Boyd Co., Sept. 25, 1937, *T. N. McCoy;* Tygart's Creek, Carter Co., Oct. 16, 1937, *E. L. Braun;* "Fernbank—ad ripas fluminis Ohio, prope 'North Bend'", *Short.* TENNESSEE: Rugby, Morgan Co., *Svenson*, no. 4048; Sunbright, alt. 2200 ft., Morgan Co., *Svenson*, no. 4117; n. of Manchester, Coffee Co., *Svenson*, no. 9256; Hollow Rock Jc., Carroll Co., *Svenson*, no. 374. ALABAMA: n. of Headland, Henry Co., *Wiegand & Manning*, no. 964; Perdido, Baldwin Co., *Blanton*, no. 7087. ILLINOIS: Pope Co., July 31, 1898, *G. P. Clinton.* MISSOURI: Jefferson Co., July, 1887, *Eggert;* Bismark, St. Francois Co., *E. J. Palmer*, no. 18,065; Monteer, Shannon Co., *Bush*, nos. 204 and 7852. ARKANSAS: Kensett, White Co., *Demaree*, no. 8658; Siloam Springs, Benton Co., *Demaree*, no. 4626; Washington Co., Aug. 17, 1895, *Blankinship;* Howard Co., *Demaree*, no. 9734; Murfreesboro, Pike Co., *Demaree*, no. 9377; Locksburg, Sevier Co., *Demaree*, no. 9890. LOUISIANA: New Orleans, 1832, *Drummond;* n. of Kisatchie, Natchitoches Parish,

D. S. & H. B. Correll, no. 9765. OKLAHOMA: Page, LeFlore Co., *Stevens*, no. 2619; Valliant, McCurtain Co., *Demaree*, no. 12,022 (appr. var. *subelliptica*). PLATES 983 and 984.

Var. VULGARIS, forma **noveboracensis** (Britton), stat. nov. *A. noveboracensis* Britton in Torreya, iv. 124 (1904) and N. Am. Trees, 264, fig. 224 (1908). *A. rugosa*, race? Britton in Britt. & Brown, Ill. Fl. ed. 2, i. 613 (1913).—Differing from typical var. *vulgaris* only in the persistent plush-like pubescence of the lower leaf-surfaces.—Scattered through the range, often abundant. MAINE: Orono, Penobscot Co., *Fernald & Long*, no. 13,473, as *A. incana*, var. *hypochlora*. MASSACHUSETTS: West Roxbury, April 5 and May 18, 1904, *F. F. Forbes*. RHODE ISLAND: Washington P., Kent Co., May 24, 1914, *Thos. Hope*. NEW YORK: Grant City, Staten I., Aug. 5, 1894, *Britton* (TYPE of *A. noveboracensis*); Selkirk, Oswego Co., *Fernald, Wiegand & Eames*, no. 14,247. NEW JERSEY: South Amboy, Middlesex Co., *Mackenzie*, no. 1465. VIRGINIA: Blackwater R., Princess Anne Co., *Fernald & Long*, no. 3898; w. of Franklin, Southampton Co., *F. & L.*, no. 6583; se. of Branchville, South. Co., *F. & L.*, no. 10,231; n. of Skipper's, Greensville Co., *F. & L.*, no. 8693. SOUTH CAROLINA: *M. A. Curtis*. GEORGIA: s. of Athens, Clarke Co., *Duncan & Roland*, no. 3877; Augusta, Richmond Co., *Olney & Metcalf*, no. 91. KENTUCKY: Harlan Court House, Harlan Co., *Kearney*, no. 7; s. of Albany, Clinton Co., *Smith & Hodgdon*, no. 3992. TENNESSEE: between Lexington and Natchez Trace Forest, Henderson Co., *Svenson*, no. 10,499. LOUISIANA: *Hale* (identified by Regel as his *A. serrulata*, var. *genuina*). PLATE 985.

Var. **subelliptica,** var. nov. (TAB. 986), foliis late elliptico-obovatis vel oblongo-ellipticis vel subrotundo-obovatis basin versus sensim rotundatis, subtus glabris vel glabratis; amentis masculis 3–7 cm. longis; strobilis maturis 1–2 cm. longis.—Georgia, north to southern New Hampshire, Massachusetts and New York. NEW HAMPSHIRE: Wheelwright P., Lee, Strafford Co., *Hodgdon*, no. 2576. MASSACHUSETTS: Rockport, Essex Co., *L. B. Smith & R. C. Gates*, nos. 964 and 965; Round P., Tewksbury, Middlesex Co., *Fernald & Bartlett*, no. 17; sandy swamp, Tewksbury, April 14 and October 14, 1906, *Fernald & Bartlett*, no. 16 (TYPE in Herb. Gray.); Winchester, Mid. Co., *F. & B.*, nos. 8, 11 and 13; West Cambridge, Mid. Co., *F. & B.*, no. 3; Fresh Pond, Cambridge, Sept. 29, 1894, *Robinson*, also *F. & B.*, no. 1; Bedford, Mid. Co., Sept. 12, 1903, *Knowlton;* Needham, Norfolk Co., April 20 and July 3, 1883, *T. O. Fuller;* Bellingham, Norf. Co., Sept. 17, 1935, *Ordway & Sanford;* Silver L., Kingston, Plymouth Co., Aug. 30, 1941, *Knowlton;* Wareham, Plym. Co., Sept. 18, 1925, *Knowlton;* Waquoit, Falmouth, Barnstable Co., *R. A. Ware*, no. 336; East Sandwich,

Barn. Co., Sept. 16, 1916, *F. F. Forbes;* Seward's P., West Barnstable, Barn. Co., *St. John & White*, no. 924; Great P., Centerville, Barn. Co., June 16, 1895, *E. F. Williams;* Walker P., Brewster, Barn. Co., *Fernald*, no. 16,681; Sheep P., Brewster, *Fernald*, no. 16,683; Cliff P., Brewster, *Fernald & Long*, no. 16,685; Davis P., Greenwich, Hampshire Co., *Pease*, no. 20,353. RHODE ISLAND: Limerock, Lincoln, Providence Co., Oct. 19, 1906, *J. F. Collins;* East Providence, Prov. Co., Oct. 17, 1906, *Collins;* Wash. P., Block Island, Newport Co., *Fernald, Hunnewell & Long*, no. 9344. CONNECTICUT: Coventry, Tolland Co., Aug., 1916, *Weatherby & Smith;* Ladd Fool Bridge, Franklin, New London Co., Aug. 24 and Sept. 6, 1912, *Woodward;* Rainbow, Windsor, Hartford Co., Sept. 20, 1908, *H. S. Clark;* Southington, Hartford Co., *L. Andrews*, no. 182; Oxford, New Haven Co., April 16, 1888 and July 30, 1899, *Harger*. NEW YORK: Long L., Hamilton Co., *House*, no. 13,513; Ashokan, Ulster Co., *Muenscher*, no. 16,104; Glycerine Hollow, Black Lake Forest, Orange Co., *Raup*, nos. 7789 and 7792; Peconic R., Southampton, Suffolk Co., *St. John*, no. 2682: Renwick Flats, Ithaca, Tompkins Co., *MacDaniels*, no. 3927. PENNSYLVANIA: near Kimbles, Pike Co., *Fogg*, no. 10,780; Allegheny Co., *Dickey*, no. 24. VIRGINIA: n. of Keyesville, Charlotte Co., *Fosberg*, no. 15,531; se. of Whitemarsh School, Nansemond Co., *Fernald & Long*, no. 11,558 (transitional); south of South Quay,Nans. Co., *F. & L.*, no. 10,611. NORTH CAROLINA: Parkville, Perquimans Co., *L. F. & F. R. Randolph*, no. 682; Raleigh, Wake Co., *Godfrey*, no. 4957; Hamlet, Richmond Co., *Wiegand & Manning*, no. 960. SOUTH CAROLINA: Pee Dee R. at Mars Bluff, Florence Co., *Wiegand & Manning*, no. 961. GEORGIA: e. se. of Statesboro, Bulloch Co., July 5, 1936, *Wherry*.

Var. SUBELLIPTICA forma **emarginata,** f. nov. (TAB. 987). Frutex ad 1.5 m. alta; foliis subrotundo-obovatis 2–5 cm. longis 1.5–4 cm. latis basin versus rotundatis apice late emarginatis paginis inferioribus glabratis; amentis masculis 2 cm. longis; strobilis maturis 5–10 mm. longis.—CONNECTICUT: open, rather sphagnous, swamp, Rainbow, Windsor, Hartford Co., Sept. 16, 1906 and April 6, 1907, *C. H. Bissell & C. A. Weatherby* (*Weatherby*, no. 2031), TYPE in Herb. Gray.

Var. SUBELLIPTICA, forma **mollescens,** f. nov. (TAB. 988). Frutex altus vel arbor fastigiata ad 8 m. alta; foliis ut in var. *subelliptica* 6–12 cm. longis apice obtusis vel acutis basin versus rotundatis subtus dense persistenterque subvelutinis; strobilis maturis 1–2 cm. longis.—Scattered through the range of the variety. NEW ENGLAND: old specimen from "Nova Anglia", *Oakes*, identified by Regel as his var. *genuina*. MASSACHUSETTS: Plum Island, Essex Co., *St. John*, no. 837; Winchester, Middlesex Co., July, 1907, *Knowlton;* Sharon, Norfolk Co., *S. F. Poole*,

no. 3; Barnstable, B. Co., *Fernald & Woodward*, nos. 15,124 and 15,126; Sheep P., Brewster, Barn. Co., *Fernald*, no. 16,682; Seth's P., West Tisbury, Dukes Co., *Fernald & Fogg*, no. 888; Brookfield, Worcester Co., *Hill, St. John & Torrey*, no. T. 261. CONNECTICUT: Thompson, Windham Co., June 11, 1922, *Eaton, Fassett, Jack, Linder & Peattie.* NEW YORK: wet hollow, Riverhead, Southampton, Suffolk Co., July 25–Aug. 3, 1920, *St. John*, no. 2681 (TYPE in Herb. Gray.). NEW JERSEY: South Amboy, Middlesex Co., *Mackenzie*, no. 1906. VIRGINIA: Little Neck, Princess Anne Co., *Fernald & Long*, no. 3899. NORTH CAROLINA: Raleigh, Wake Co., *Godfrey*, no. 4052; Gilson, Scotland Co., *Godfrey*, no. 5073.

Var. *subelliptica*, at the northern border of its range, has often been taken for a hybrid of *Alnus serrulata* (var. *vulgaris*) and *A. rugosa* (var. *typica*) and in outline of leaf it is suggestive of such an origin. It has, however, the characteristic bark, glutinous or gummy quality, branching of inflorescence and venation and serrulation of leaves of *A. serrulata*, not of *A. rugosa.* In southern New England and New York the two species meet, but farther south, from eastern Maryland to Georgia, no representative of the latter species is known.

Var. SUBELLIPTICA, forma **nanella,** f. nov. (TAB. 989), nana, 0.5–1 m. alta; foliis elliptico-obovatis 2–5 cm. longis, subtus subvelutinis; strobilis maturis 6–12 mm. longis.—VIRGINIA: dwarf shrubs with scattered simple stems only 5–8 mm. thick, springy sphagnous and argillaceous bog, Ram-hole Swamp, Seward Forest, near Triplett, Brunswick Co., June 22 and Sept. 13, 1944, *Fernald* (*and Lewis*), no. 14,596 (TYPE in Herb. Gray.); with *Lachnocaulon anceps, Sarracenia flava*, etc., bushy sphagnous swamp southeast of Petersburg, at head of Poo Run, Prince George Co., *Fernald & Long*, no. 6167.

EXPLANATION OF PLATES

PLATE 976, ALNUS INCANA (L.) Moench.: FIG. 1, leading shoot, with foliage and young aments, × 1, from Breslau, Sept. 20, 1908, *Ziesché;* FIG. 2, lower surface of leaf, × 10, from Charlottenbrunn, Silesia, *Baenitz*, no. 1373; FIG. 3, inflorescence, × 1, from Möenlycke, April, 1890, *Walter Unlemann*, Fl. Scand.; FIG. 4, mature cones, from *Baenitz*, no. 1373; FIG. 5, half a cone, × 4, from Wurzburg, *Fl. exsicc. Bavar.*, no. 56; FIG. 6, bract, × 10, from Bohemia, July, 1887, *Fopitze;* FIG. 7, nutlet, × 10, from same specimen as fig. 6.

PLATES 977 and 978, A. RUGOSA (Du Roi) Spreng., var. TYPICA H. Winkl. PLATE 977: FIG. 1, fruiting branch, × 1, of shrub spread from cultivation in Europe, from Gehölze an der Lüneburger Eisenbahn nach Motrich, Wittenberge, *Baenitz, Herb. Dendrol.* no. 1214; fig. 2, venation of lower leaf-surface, × 10, from no. 1214; FIG. 3, half a cone, × 4, from no. 1214; FIG. 4, nutlet, × 10, frrom no. 1214. PLATE 978: FIG. 1, fruting branch from Narrows Island, Black Lake, New York, *Fernald, Wiegand & Eames*, no. 14,251; FIG. 2,

venation of lower leaf-surface, × 10, from no 14,251; FIG. 3, portion of cone, × 4, from no. 14,251; FIG. 4, achene, and FIG. 5, bract, × 10, from no. 14,251.

PLATE 979, FIGS. 1–3, A. RUGOSA, var. TYPICA: FIG. 1, terminal leaves of vegetative sprout, × ca. ½, from TOPOTYPE, Harbke Garten, *Ehrhart*, no. 88; FIG. 2, branches of strictly pistillate shrub, × 1, from Townshend, Vermont, June 2, 1912, *L. A. Wheeler;* FIG. 3, inflorescence, × 1, from West Roxbury, Massachusetts, April 9, 1906, *F. F. Forbes.* FIG. 4, forma EMERSONIANA Fernald: lower surface of leaf, × 10, from TYPE.

PLATES 980 and 981, A. RUGOSA, var. AMERICANA (Regel) Fernald. PLATE 980: FIG. 1, fruiting branch, × 1, from Douglastown, Gaspé Co., Quebec, Aug. 22, 1904, *Collins, Fernald & Pease;* FIG. 2, bark, × 1, from Rindge, New Hampshire, Sept. 8, 1917, *C. F. Batchelder;* FIG. 3, group of cones, × 4, from same specimen as fig. 1. PLATE 981: FIG. 1, foliage and young aments of larger-leaved specimen, × 1, from Hillsborough, New Hampshire, Sept. 3, 1921, *C. F. Batchelder;* FIG. 2, inflorescence, × 1, from Buckland, Massachusetts, April 11, 1904, *F. F. Forbes.*

PLATE 982, FIGS. 1–3, A. RUGOSA, var. AMERICANA, forma HYPOMALACA Fernald: FIG. 1, foliage, × 1, of TYPE; FIG. 2, foliage of vigorous sprout, × 1, from Tewksbury, Massachusetts, *Fernald & Bartlett*, no. 15; FIG. 3, lower surface of leaf, × 10, from TYPE. FIG. 4, var. AMERICANA, forma TOMOPHYLLA Fernald; leaf, × 1, from TYPE.

PLATES 983 and 984, A. SERRULATA (Ait.) Willd., var. VULGARIS Spach. PLATE 983, extreme with more acute leaves, "Foliis obovatis acutis", *Aiton:* FIG. 1, foliage of vigorous sprout-shoot, × 1, from Newton, Massachusetts, *Wm. Boott;* FIG. 2, foliage and incipient inflorescence of fertile branch, × 1, from Oceana, Virginia, *Fernald & Long*, no. 3896; FIG. 3, inflorescence, × 1, from Centerville, Massachusetts, April 18, 1897, *E. F. Williams;* FIG. 4, old cones, × 1, from Weymouth, New Jersey, *Long*, no. 25,358; FIG. 5, half a cone, × 4, from Stoneham, Massachusetts, April 16, 1896, *W. P. Rich;* FIG. 6, nutlet, × 10, from *Long*, no. 25,358. PLATE 984, extreme with obtuse leaves; FIG. 1, TYPE, × 1, of var. *obtusifolia* Regel; FIG. 2, narrower leaf (approaching forma *nanella*), × 1, from Richmond, Rhode Island, Aug. 20, 1919, *Fernald & Collins;* FIG. 3, broadest-leaved extreme, approaching var. *subelliptica*, × 1, from Wareham, Massachusetts, Sept. 18, 1928, *C. H. Knowlton;* FIG. 4, venation of lower leaf-surface, × 10, from same leaf as in fig. 2; FIG. 5, young inflorescences of staminate shrub, × 1, from south of South Quay, Virginia, *Fernald & Long*, no. 11,559.

PLATE 985, A. SERRULATA, var. VULGARIS, forma NOVEBORACENSIS (Britton) Fernald: FIG. 1, TYPE, × ½, of *A. noveboracensis* Britton; FIG. 2, tip with incipient inflorescence, × ½, from Selkirk, Oswego Co., New York, *Fernald, Wiegand & Eames*, no. 14,247; FIG. 3, fruiting cones, × 1, from no. 14,247; FIG. 4, lower surface of leaf, × 10, from no. 14,247; FIG. 5, bark, × 1, from Orono, Maine, *Fernald & Long*, no. 13,473.

PLATE 986, A. SERRULATA, var. SUBELLIPTICA Fernald, all figs. from TYPE: FIG. 1, foliage and incipient inflorescence, × 1; FIG. 2, inflorescence, × 1; FIG. 3, fruit, × 1; FIG. 4, bract, × 10; FIG. 5, nutlet, × 10.

PLATE 987, A. SERRULATA, var. SUBELLIPTICA, forma EMARGINATA Fernald, all figs. from TYPE: FIG. 1, fruiting branch, × 1; FIG. 2, largest leaves, × 1; FIG. 3, flowering tip, × 1; FIG. 4, lower surface of leaf, × 10.

PLATE 988, A. SERRULATA, var. SUBELLIPTICA, forma MOLLESCENS Fernald: FIG. 1, leaf and incipient inflorescence, × 1, from TYPE; FIG. 2, old cones, × 1, of TYPE; FIG. 3, lower surface of leaf, × 10, from TYPE; FIG. 4, branch with unusually long cones, × 1, from Little Neck, Virginia, *Fernald & Long*, no. 3899.

PLATE 989, A. SERRULATA, var. SUBELLIPTICA, forma NANELLA Fernald, all figs. from TYPE: FIGS. 1 and 2, fruiting branches, × 1; FIG. 3, lower surface of leaf, × 10; FIG. 4, nutlet, × 10.